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The credit signals that matter most for sovereign bond spreads with split rating

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Abstract

We investigate how split ratings influence the information content of credit rating events on the sovereign bond markets during 2000-2012. We find that market reactions are far stronger for negative events on the inferior ratings and for positive events on the superior ratings. Such evidence suggests aversion of market participants to the ambiguity inherent in split ratings. Sovereign credit spreads are particularly responsive to negative events by S&P (the more conservative agency in the sample). Moody's positive events have a significant impact only when Moody's assigns superior pre-event ratings compared with S&P. There is little evidence that split ratings involving Fitch have any market implication.

JEL classification: G15; G24

Keywords: Sovereign credit event; Ambiguity aversion; Split ratings; Bond spreads.

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1. Introduction

Most sovereign governments are rated by at least two leading credit rating agencies (CRAs). As a consequence of rating actions during the global financial crisis, split ratings (divergence in two CRAs' ratings of a sovereign) have become increasingly common. Prior empirical studies on split ratings have primarily focused on the causes of split corporate ratings and the market perception of corporate default risk associated with split-rated issuers (e.g. Livingston and Zhou, 2010; Livingston et al., 2010). For sovereign ratings, Hill et al. (2010) highlight the significant effect of split ratings on sovereign rating assessments. However, the literature remains silent on whether split sovereign ratings influence market participants' reactions to rating actions. Prior studies of the market impact of sovereign credit events ignore the effects of split ratings between CRAs (e.g. Gande and Parsley, 2005; Afonso et al., 2012).

Consistent with Livingston et al. (2010), we use 'superior' and 'inferior' to refer to higher and lower ratings, respectively, in a situation of split ratings. Positive (negative) events on the superior (inferior) rating set a new rating ceiling (floor). These are often perceived as signals that additional rating events are likely to follow. In addition, split ratings imply ambiguity about an issuer's creditworthiness and could induce investors' actions which are not explained solely by the implied changes in risk (Ellsberg, 1961). Prior literature suggests that investors demonstrate aversion in situations of ambiguity. According to Epstein and Schneider (2008), agents facing ambiguity act asymmetrically as if their conditional probability is associated with a 'worst case' scenario, i.e. good news is considered very unreliable and bad news is considered very reliable (which will induce stronger reactions of asset prices). Antoniou et al. (2014) test this argument in the setting of stock price reactions to earning forecast announcements for small (and ambiguous) firms. Their empirical evidence for the negative forecast announcements directly supports the 'worst-case' argument in

Epstein and Schneider (2008). They find that ambiguity results in mispricing of small-cap stocks in the event window [-2, +2], which is corrected upwards in the post-event period.

This paper's objective is to identify the extent to which split ratings affect the bond market response to CRAs' sovereign credit events. To the best of our knowledge, no prior research has addressed this question. Given the influence of sovereign ratings on borrowing costs, we focus on the movements of sovereign credit spreads over US Treasury benchmarks following sovereign credit events by the largest CRAs: Standard & Poor's (S&P), Moody's Investors Service (Moody's) and Fitch. We focus on cases where sovereigns are rated unequally by pairs of these CRAs prior to the credit events. We also consider cases where the splits encompass three ratings simultaneously, which has not been examined previously. This paper provides empirical evidence for the importance of split ratings in determining the information content of rating actions, thereby bridging gaps in the literature. We demonstrate that negative credit events on the inferior ratings (in a split pair) induce greater changes in sovereign spreads than negative changes to superior ratings. Similarly, positive credit events on superior ratings induce greater changes in sovereign spreads than positive changes to inferior ratings.

The empirical investigation uses a comprehensive dataset on sovereign credit ratings, outlooks and watch statuses assigned by the largest three CRAs during the period from September 2000 to December 2012. This dataset presents a significant advantage over previous literature on split corporate ratings, in which split ratings are expressed solely as the number of notch differences. In this paper, sovereign ratings, outlook, and watch are incorporated into comprehensive credit ratings (CCR) which are measured with a 58-unit linear scale. Split sovereign ratings are measured with CCR; hence reflecting a complete view of differences of opinion across the CRAs over sovereign credit quality and the potential changes in sovereign credit quality.

Five major findings emerge from our analysis. First, negative credit events induce significant spread adjustments but positive news has much less impact. Sovereign credit spreads are only significantly responsive to negative events by S&P, which is the most conservative CRA in this data sample. A one notch downgrade (negative outlook signal) by S&P is associated with a 25.8 (8.6) basis point average increase in spreads within a two day event window [0, +1]. Second, the immediate spread movements following negative events are three times larger for inferior pre-event ratings than for superior pre-event ratings by S&P (compared with Moody's). These results lend support to our prediction and are also consistent with the argument of the 'worst-case behaviour' under ambiguity, as proposed by Epstein and Schneider (2008). Third, Moody's positive events have a significant impact when Moody's assigns superior pre-event ratings than S&P but are insignificant when Moody's assigns inferior pre-event ratings. When Moody's pre-event ratings are compared simultaneously with S&P and Fitch, we only find significant bond market reactions to Moody's positive events for sovereigns with superior ratings by Moody's (versus S&P and Fitch). Fourth, despite the growing market share of Fitch during the sample period, their rating actions have very minimal bond market impact. Pre-event rating disagreements between S&P or Moody's versus Fitch do not influence the market response to S&P and Moody's credit news. Finally, common risk factors proxied by US Treasury rates, US interest rate swap spreads over US Treasury benchmarks and the VIX implied volatility index demonstrate correlations with the short-term changes in sovereign credit spreads.

The rest of the paper is organized as follows: Section 2 summarizes related literature on sovereign credit ratings and split ratings, Section 3 explains the data sample, Section 4 presents the research methodology, Section 5 discusses the results and Section 6 concludes.

2. Literature Review

Sovereign ratings represent a measure of the credit risk of a given country, and a ceiling for the ratings assigned to non-sovereign issuers within the country, although the ceiling is no longer applied in an absolute sense by the largest CRAs (Borensztein et al., 2013). CRAs' credit opinions have a widespread impact on various segments of the financial system. Prior studies find strong and significant relationships between negative sovereign credit rating actions and equity market returns, currencies, bond spreads, CDS spreads, and implied volatility while positive news has an insignificant or limited impact (e.g. Kaminsky and Schumkler, 2002; Afonso et al., 2012; Alsakka and ap Gwilym, 2012; Tran et al., 2014). Higher moments of returns in currency, equity, and government bond markets are also highly correlated with credit rating news (Do et al., 2014), particularly the negative news (Afonso et al., 2014). Sovereign rating actions generate cross-border effects (Gande and Parsley, 2005; Ferreira and Gama, 2007; De Santis, 2014) and cross-country correlations in the equity and bond markets (Christopher et al., 2012).

Market participants distinguish between the sovereign credit events from different CRAs. For example, Afonso et al. (2012) find that bond credit spreads react significantly to S&P's negative credit news, whereas announcements from Moody's and Fitch bring little information content for the market. Empirical evidence also shows that outlook and watch signals are at least as important as actual rating changes in terms of the impact on financial markets (e.g. Sy, 2004; Alsakka and ap Gwilym, 2012).

Prior research on the informational content of split ratings has been conducted for corporate issuers only. Micu et al. (2006) find that credit events for split rated corporate issuers cause more reactions in CDS spreads than events for pre-event non-split rated corporates.[1] May (2010) hypothesizes that corporate rating changes to multiple rated issues that either mitigate or eliminate the gaps between the two ratings should have less influence on daily abnormal bond returns. However, the proposition is not supported by their evidence. Bongaerts et al. (2012) focus on corporate split ratings where S&P and Moody's ratings are on opposite sides of the investment grade boundary. They define Fitch as the third rater and find a reduction of 41 basis points in yield spreads when Fitch rates the issues as investment grade. This implies evidence of the regulatory certification effect, i.e. corporates seek a third rating from Fitch as a "tie-breaker" for debt issues which are split-rated by S&P and Moody's.

In the corporate rating literature, several papers concentrate on discovering which rating is priced, but the results are inconsistent. Billingsley et al. (1985) and Perry et al. (1988) reveal that the inferior rating determines bond yield or investors lean toward the more conservative CRA risk assessments. Therefore, split-rated bonds could be more expensive for debt issuers than equally-rated bonds. In contrast, Hsueh and Kidwell (1988) and Reiter and Ziebart (1991) find that bond yields are more closely associated with the superior rating. Hence, split-rated bonds could be cheaper from the issuers' perspective. The cost-saving effect of split ratings ranges from 16 to 21 basis points in Hsueh and Kidwell (1988).

Cantor et al. (1997) and Jewell and Livingston (1998) show that both S&P and Moody's corporate ratings are relevant to spreads, but inferior ratings have a stronger effect on spreads compared with superior ratings due to investors' risk aversion. Livingston and Zhou (2010) argue that the deviation in yield from that implied by the average ratings toward that of the inferior one represents the bondholders' required premium on the information opaqueness of split rated corporate issuers. However, the yield premium on information

[1] They do not distinguish between superior and inferior pre-event ratings as done in this paper (see Sections 4 and 5).

opaqueness is eight basis points higher if Moody's assigns lower ratings than S&P. Apparently, the market-perceived corporate credit risk is more strongly associated with ratings from Moody's (the more conservative CRA according to their data).

Our study is motivated by Livingston et al. (2010) who show that the pricing of corporate credit risk is exercised not only based on the CRA's credit opinions but also on the opinion differences, where the heavier weight is placed on the more conservative CRA. Whereas Livingston et al. (2010) study the level of primary spreads and concentrate on credit ratings of newly issued corporate bonds in the US, we examine the movements of secondary spreads on outstanding sovereign bonds during credit event windows and focus on sovereign issuers. Additionally, we consider CRAs' forward looking view of the future direction of ratings captured by outlook and watch signals, which are not included in Livingston et al. (2010). Fitch credit events are also considered. We expect that there are heterogeneous spread adjustments to credit events on the superior ratings and inferior ratings for the split-rated sovereigns. Specifically, negative events on inferior ratings are expected to have a stronger influence on spreads than negative events on superior ratings. Positive events on superior ratings are expected to have a stronger influence on spreads than positive events on inferior ratings. Livingston et al. (2010) argue that conservative credit opinions have a heavier weight in pricing the default risk premium; we thus expect credit events from the more conservative CRA to trigger more noticeable adjustments in sovereign spreads.

3. Data

3.1. Data selection

The study employs a rich dataset of daily observations of long-term foreign-currency sovereign credit ratings, outlook and watch status during the period from 21st September 2000 to 31st December 2012. The sample starts on the date when Fitch officially started to assign outlook on sovereign credit ratings. The data are collected from CRA publications. The initial database contains 463,395 daily observations of ratings, outlooks and watch status assigned to 122 sovereigns by S&P, Moody's and Fitch. Every sovereign in the sample is rated by two or three of these CRAs. Ratings, outlook and watch status for each day are converted to a 58-unit comprehensive credit rating (CCR) numerical score (Sy, 2004). Adjacent notches on the conventional 20 notch rating scale differ by 3 units on the 58-unit rating scale (AAA/Aaa = 58, AA+/Aa1 = 55 … CCC-/Caa3 = 4, CC/Ca to C/SD/D = 1). Then CCR is adjusted upwards by one (two) unit(s) if the outlook (watch) is positive. The CCR is adjusted downwards by one (two) unit(s) if the outlook (watch) is negative.

The credit events could be upgrades or downgrades on the rating levels, outlook and watch signals indicating potential upgrades or downgrades, or confirmations of the ratings following outlook or watch signals. CRAs may decide to simultaneously upgrade (downgrade) the sovereign ratings and put the sovereigns on positive (negative) outlook/watch (considered as one combined event on the CCR rating scale). We refer to every change which decreases the CCR as a negative credit event, and every change which increases the CCR as a positive event. Initially, the dataset contains 1,938 credit events. We exclude 31 occurrences of simultaneous events (credit announcements by more than one CRA on a sovereign on the same day).

For data on sovereign bond spreads, we identify straight, unsecured, publicly placed, fixed coupon bearing notes and bonds with 1 to 30 years remaining maturities and issued in

US dollars by the sovereigns subject to the credit events. We exclude bonds with unique characteristics such as inflation index linked, structured notes/bonds and bonds with dual currency. The source of sovereign bonds' characteristics and bond pricing is Bloomberg L.P. From 987 bonds satisfying the filtering criteria, 625 bonds have pricing information available from Bloomberg. There is often more than one bond outstanding for a given sovereign on an event date. Gande and Parsley (2005) choose one representative bond for each sovereign and observe the bond prices throughout the sample period. This method may discard too many events for which pricing information of the selected bond is not observable. Therefore, we pool all the outstanding bonds for each event and select the largest one by issue size to benefit from the richness of the data. For every event of a given sovereign, there is only one bond selected.

We obtain from Bloomberg the bond characteristics, such as remaining maturity, issue amount, annual coupon rate, and annual effective yield to maturity. Spreads are measured in basis points and defined as the differences between the yield to maturity of the outstanding sovereign bonds issued by the sovereigns subject to the credit events and a (maturity and coupon) comparable US Treasury benchmark bond. Identifying a perfectly comparable benchmark bond for every single sovereign bond is difficult, therefore we apply the same bond filtering criteria as for other sovereign bonds and find the benchmark bonds whose maturity and coupon offer the closest match. Because US Treasury bonds are chosen as the benchmark for calculating the sovereign credit spreads, our sample excludes (the few) sovereign credit events on the United States.

On matching the sovereign credit data with the bond spread data, we find 918 credit events having available bond spread information from the initial set of 1,907 events. We then exclude events that correspond to pre-event non-split rated sovereigns or where bond spreads are negative. The final sample includes 800 events for 68 pre-event split-rated sovereigns.

3.2. Descriptive statistics of the sample

The sample includes 297 events from S&P, 256 events from Moody's and 247 events from Fitch for 68 split rated sovereigns during the period from 21st September 2000 to 31st December 2012. The sample comprises the following types of events: 177 (111) solo positive (negative) outlook signals, 58 (42) solo positive (negative) watch announcements, 107 (69) solo rating upgrades (downgrades) and 143 (93) combined events of rating upgrades (downgrades) and positive (negative) outlook/watch signals simultaneously. Most of the actual rating upgrades or downgrades are by one-notch on the 20-notch scale. Multiple-notch changes occur infrequently, but more often in downgrades (29.6% of cases) than in upgrades (12.4%). We find that 87.7% (58.8%) of rating downgrades (upgrades) are preceded by negative (positive) outlook/watch signals, implying that CRAs use outlooks and watch signals as early indicators of potential rating changes more often for sovereigns subject to potential downgrades than upgrades. This also implies that outlook and watch signals are becoming increasingly utilised. Among the three CRAs, Moody's upgrade decisions are those most commonly preceded by outlook and watch signals. For rating downgrades preceded by negative outlook and watch signals, the differences are less substantial across CRAs.

Across the whole sample period, the three CRAs release more positive events than negative events. Prior to 2008, there are more positive events on sovereigns in emerging countries than for developed sovereigns. There is a marked increase in negative events (especially for developed countries), starting in 2008 and peaking at the height of the European sovereign debt crisis in 2011.

Table 1 describes the sample of credit events, partitioning the sample into three groups: group 1 (2) includes credit events on 61 (57) split rated sovereigns by S&P and Moody's (Fitch) and group 3 includes events on 47 split rated sovereigns by Moody's and

Fitch.[2] Rows 1 - 12 of Table 1 summarize the basic statistical properties of the three samples.[3] The average rating differential between two CRAs in each group is approximately 3 CCR units, which is equivalent to one notch difference on the 20-notch rating scale. The rating differences vary from one CCR unit (an outlook status) to 18 CCR units (6 notches). Row 12 of Table 1 shows that S&P rates lower than Moody's and Fitch for 56.7% and 64.4% of the samples respectively, whereas Moody's rates lower than Fitch for 52.2% of that sample. S&P assigns more inferior ratings than superior ratings compared with either Moody's or Fitch. S&P also releases more negative events than Moody's and Fitch. For this sample, S&P is the most active CRA in taking actions in the context of deteriorating sovereign credit risk, and tends to assign lower ratings than Moody's and Fitch. Therefore, we anticipate that S&P credit events may induce stronger reactions in spreads than credit events from Moody’s and Fitch, particularly for negative signals.

In Table 1, for each group, there are two (superior and inferior) sub-groups for which the distribution of credit events by each CRA are presented in rows 13-19. Column 3 (4) displays the distribution of S&P (Moody's) credit events for sovereigns rated unequally by S&P and Moody's. Column 5 (6) displays the distribution of S&P (Fitch) credit events for sovereigns rated unequally by S&P and Fitch. Column 7 (8) displays the distribution of Moody's (Fitch) credit events for sovereigns rated unequally by Moody's and Fitch. We calculate the number of events affecting the pre-event inferior ratings in rows 14 and 17 and pre-event superior ratings in rows 15 and 18. For instance, 59.6% of negative events and 66.4% of the positive events by S&P for those jointly and unequally rated by S&P and

[2] Some sovereigns have more than one bond outstanding on the event dates; we select the bonds with the largest issue amounts. There may be more than one bond considered for a sovereign experiencing multiple events at different points in time during the period, and this explains why there are more bonds than sovereigns in each group.

[3] 56 of 68 split-rated sovereigns in the final event sample are rated by all three CRAs, so the three groups may overlap.

Moody's occur to sovereigns rated lower by S&P than by Moody's (see Column 3). Similarly, 40.4% (33.6%) of S&P events on sovereigns unequally rated by Moody's are “negative (positive) events on superior ratings by S&P compared with Moody's”.

In general, a “negative event on inferior ratings by CRA1 compared with CRA2” (row 14) is a negative event by CRA1 on a sovereign already rated lower by CRA1 than by CRA2 on the event date. A “positive event on superior ratings by CRA1 compared with CRA2” (row 18) is a positive event by CRA1 on a sovereign already rated higher by CRA1 than by CRA2 on the event date. Both of them have the effect of increasing the rating differential between CRA1 and CRA2. In contrast, a “negative event on superior ratings by CRA1 compared with CRA2” (row 15) and a “positive event on inferior ratings by CRA1 compared with CRA2” (row 17) have the effect of reducing, eliminating or reversing the sign of rating differences between CRA1 and CRA2.

Table 1 shows that the distribution of credit events from Moody's and Fitch are relatively unbalanced. There are more negative events on superior ratings than on inferior ratings in both the Moody's event sub-samples (columns 4 and 7) and in the Fitch event sub-samples (columns 6 and 8). Moody's and Fitch also release more positive signals on inferior ratings than on superior ratings. In the sub-samples of S&P events, the distributions are fairly balanced between negative events (positive events) on inferior ratings and on superior ratings (rows 3 and 5). However, it is noticeable that S&P has more negative events on its inferior ratings. Overall, this is suggestive of a more conservative sovereign rating policy by S&P.

4. Methodology

We employ regression analysis to investigate the immediate impact on sovereign bond credit spreads of credit events on split rated sovereigns. We first fit a baseline model for each CRA's credit events:

$$\begin{aligned}\Delta SPREAD_{it} &= \alpha + \beta\Delta CCR_{it} + \gamma_1 MATURITY_{it} + \gamma_2 CCR_{it} + \gamma_3 PRIOREVENTS_{it} \\ &\quad + \gamma_4 GRISK_t + \delta reg_i + \varphi y_t + \varepsilon_{it}\end{aligned} \tag{1}$$

$\Delta SPREAD_{it}$ is the spread change measured in basis points in the [0, +1] time window for the selected bond issued by sovereign *i* subject to the credit event by the CRA on date *t*. Following Gande and Parsley (2005) and Ferreira and Gama (2007), spread changes are computed in the [0, +1] window in order to reduce any effect of clusters of credit events which could potentially bias the results.

ΔCCR_{it} is the credit event variable, measuring the change in the 58-unit comprehensive credit rating (CCR) for sovereign *i* on event date *t*. For ease of interpretation, we take the absolute values of ΔCCR_{it}. The slope coefficient β reflects the marginal movement of spreads in response to a unit change of CCR (i.e. an outlook signal).

$MATURITY_{it}$ is the natural logarithm of the remaining years to maturity for the bond issued by sovereign *i* on the event date *t*. This controls for any heterogeneity in spread changes for bonds with differing remaining terms to maturity.

CCR_{it} is the comprehensive credit rating assigned to sovereign *i* before the credit event is announced on date *t*, which is a control for the economic fundamentals, political and financial conditions of sovereign *i* when the event occurs.

$PRIOREVENTS_{it}$ is the cumulative CCR change of sovereign *i* during 14 days prior to day *t*, which captures the intensity of event clustering documented in Gande and Parsley (2005).

Net positive changes of CCR in the previous 14 days indicate an upgrade trend whereas net negative changes of CCR in the previous 14 days indicate a downgrade trend.[4]

$GRISK_t$ is a proxy of a global risk factor which has a significant effect on sovereign credit spreads (Favero et al., 2010). The need to control a model of government bond spreads for global risk factors is highlighted in Eichler (2014). Therefore, we add to the right hand side of Eq. (1) the variable $GRISK_t$ which represents the dynamics of global economic and financing conditions, as well as market participants' risk appetite. Based on Longstaff and Schwartz (1995), Favero et al. (2010) and Oliveira et al. (2012), Eq. (1) includes one of three proxies of global risk: CBOE VIX index, the 5 year interest rate swap spreads over the US Treasury yield curve and the 10 year US Treasury interest rate. The data on these risk measures are obtained from Datastream. The proxies of global risk are defined as the contemporaneous logarithmic changes in the window [0, +1] surrounding the events. Because spreads are benchmarked against US interest rates, we opt for US based measures of international risk due to their exogeneity. We control for the fixed-effects of geographic regions and time trends by adding a full set of region dummies reg_i and time dummy variables y_t.[5] The purpose of fitting the baseline model is to verify whether credit events bring significant information content for the sovereign bond markets and whether the market reacts heterogeneously to the events from the three CRAs.

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[4] For *PRIOREVENTS*, the 14-day period preceding the event is chosen to be consistent with Gande and Parsley (2005) and Ferreira and Gama (2007). Alternative specifications for *PRIOREVENTS* with 10 and 30 days look-back periods produced similar results (available from the authors on request).

[5] Sovereigns are classified into four regions (using the World Bank definitions): (1) Europe and Central Asia (the base region), (2) North America, Latin America and Caribbean, (3) South Asia, East Asia and Pacific, (4) Middle East, North Africa and Sub-Saharan Africa. Time is represented by dummies of four periods: (1) 2000 to 2002, characterized by the bursting of the dot.com bubble in developed countries and the episodes of sovereign debt defaults in emerging countries (the base period), (2) 2003 to 2006, the pre-crisis period, (3) 2007 to 2009, the global financial crisis, (4) 2010 to 2012, the euro zone's sovereign debt crisis and the global recession.

We examine the credit events on sovereigns with pre-event split ratings assigned by two or three global CRAs. We investigate the asymmetric responses of credit spreads to events on superior ratings and on inferior ratings by fitting the second model:

$$\begin{aligned}\Delta SPREAD_{it} &= \alpha + \beta_1 \Delta CCR_{it} \times SUP_{it} + \beta_2 \Delta CCR_{it} \times INF_{it} + \gamma_1 MATURITY_{it} \\ &\quad + \gamma_2 CCR_{it} + \gamma_3 PRIOREVENTS_{it} + \gamma_4 GRISK_t + \delta reg_i + \varphi y_t + \varepsilon_{it}\end{aligned} \tag{2}$$

In Eq. (2), the credit event variable ΔCCR_{it} is interacted with two separate dummy variables namely SUP_{it} and INF_{it}. SUP_{it} is a dummy variable that takes the value of one if the CRA's ratings subject to the positive or negative events are superior (pre-event) compared with the other CRA, and zero otherwise. INF_{it} is a dummy variable that takes the value of one if the CRA's ratings subject to the positive or negative events are inferior (pre-event) compared with the other CRA. Because Eq. (2) takes into consideration the split ratings of two CRAs, we define the variable *CCR* as the average of the ratings assigned by the two CRAs to sovereign *i* on day -1.

We estimate Equations (1) and (2) using credit events by each CRA and separately for negative events and positive events. Since there are three CRAs involved in the study, there are three pairs of CRAs (versus one pair in Livingston et al. (2010)). This data breakdown has been applied to Table 1, as discussed earlier. We fit Eq. (2) on every sub-group.[6]

[6] Following Kurov (2010), we apply Yohai's (1987) MM-robust regression method using the full range of available observations to detect influential data points before estimating Equations (1) and (2). We identify the influential data points in the samples based on the post MM-robust regression estimates of the robust standardized residuals and robust distance. Every observation whose standardized residual and/or robust distance lies far beyond the 'normal range' is an outlier and is hence deleted from the samples. The definition of normal range depends on the distributions of the standardized residuals and robust distance which vary across the samples. Nonetheless, in most of the cases, outliers are outside the range [-5, +5] of robust standardized residuals and [0, 40] of the robust distance. The regressions are fitted as specified only after outliers have been eliminated.

Following Ferreira and Gama (2007), we create a bond-matched sample of non-event dates for every sub-group of events. The non-event samples are drawn randomly from the pools of non-event dates during the period from September 2000 to December 2012 for the bonds observed in the event sub-groups. A clean non-event day for a sovereign is not preceded by any credit events on that sovereign by any CRA within 30 days before the non-event day, nor is it followed by credit events by any CRA within 30 days after the non-event day. Therefore, we estimate Equations (1) and (2) with both credit event and non-event data. The coefficient estimates of the credit event variable measure the incremental sovereign credit spread change in response to a change of one CCR unit vis-à-vis no change in ratings. We apply Huber-White robust standard errors in estimating Equations (1) and (2).

We anticipate that spreads over US Treasury rates widen on announcements of negative credit events and narrow on announcements of positive events. Hence, β in Eq. (1) is expected to have negative signs in the positive events' models and positive signs in the negative events' models. We also expect that there are significant differences in the reactions of spreads to events on superior ratings and to those on inferior ratings. In particular, negative events on inferior ratings are expected to have more impact than negative events on superior ratings. Positive events on superior ratings are expected to be more informative than those on inferior ratings. Regarding the comparative effects of two rating action variables, we perform a formal statistical F-test of the equality of coefficients β_1 and β_2 in Eq. (2). The constrained model (2*) is estimated on the same data sample as the unconstrained Eq. (2) and specified such that $\Delta CCR_{it} \times SUP_{it}$ and $\Delta CCR_{it} \times INF_{it}$ have an equal effect on spreads (they are replaced by a variable $X_{it} = \Delta CCR_{it} \times SUP_{it} + \Delta CCR_{it} \times INF_{it}$).

5. Empirical results

5.1. The baseline model – Equation (1)

Table 2 reports the estimation results of Eq. (1), which examines the information content of credit events from three CRAs, separately, for split rated sovereigns. Panel A presents the results for negative events. The coefficient $\hat{\beta}$ on ΔCCR has the anticipated sign for all three CRAs in every model specification, but only negative events by S&P have a significant impact on spreads. Given that S&P sovereign ratings have a tendency to be lower than those assigned by Moody's and Fitch (see Table 1), this result is consistent with an argument that market perception of sovereign credit risk is heavily influenced by the more conservative CRA (in Livingston et al. (2010), it was Moody's). The coefficient estimate on ΔCCR_{it} (specification IV) reveals that spreads increase by 25.8 (8.6*3) basis points when S&P announces a downgrade by one notch (three CCR units).

In contrast to negative events, Panel B of Table 2 shows that positive rating events have a very minimal impact on the sovereign bond markets.[7] The evidence for all three CRAs is weak. This is also consistent with the findings in the prior literature that market impact of rating events is highly asymmetric (e.g. Afonso et al., 2012).

5.2. Split rating effect – Equation (2)

Tables 3, 4 and 5 present the results for Eq. (2) which examines the specific effects of credit events on pre-event superior and inferior ratings. In all model specifications, there is evidence for asymmetry in the information content of negative and positive credit events. Spreads are less responsive to positive events than to negative events. In the case of S&P's negative events for those jointly (and unequally) rated by Moody's, the coefficient estimates

[7] Positive events by Fitch are statistically significant at the 5% level in one specification but the sign is incorrect.

of $\Delta CCR_{it} \times SUP_{it}$ and $\Delta CCR_{it} \times INF_{it}$ support our predictions that negative events on the inferior ratings induce stronger reactions in sovereign spreads than those on superior ratings. At the 5% significance level, only the spread reactions to S&P's negative actions on the inferior ratings (versus Moody's) are significant. Their coefficient magnitudes are also approximately 4 times larger than those of the negative events on the superior ratings. Average credit spread increases in the event window [0, +1] can be up to 40.2 (13.4*3) basis points when the inferior ratings are downgraded by one notch by S&P. These results are supported by the F- test for the equal impact of $\Delta CCR_{it} \times SUP_{it}$ and $\Delta CCR_{it} \times INF_{it}$ on spreads in the event window (See Table 3).

When considering the sample of S&P's negative events for those jointly (and unequally) rated by Fitch, the evidence is weaker. In specification (I) of Eq. (2), the larger effect on spreads is triggered by S&P negative events on the superior ratings (versus Fitch), but the F-statistic is not significant. Only the coefficient of $\Delta CCR_{it} \times INF_{it}$ is statistically significant and robust to the different model specifications (See Table 3).

In general, the results for Eq. (1) in Table 2 reveal little evidence of bond market reactions to positive credit events. However, in Table 4, positive credit events by Moody's trigger meaningful spread adjustments when they affect the superior ratings, though their impact is not as sizeable as S&P's negative credit events. Spreads are lowered by approximately 9 (2.92*3) basis points following Moody's announcements of increasing the pre-event superior ratings (versus S&P) by one notch (Eq. (2) – Specifications I and II). On the other hand, the market impact of Moody's positive events on Moody's inferior ratings (versus S&P) is insignificant. According to the F-test of the difference between the two coefficients, positive changes on the pre-event superior Moody's ratings (versus S&P) trigger significantly greater reactions in spreads.

The results strongly indicate that not only the rating changes but also the rating differences across CRAs are taken into consideration by the market, and sovereign spread reactions are driven by both. Positive credit events affecting the superior rating set a new ceiling for the ratings and they might also lead an upgrade trend. As a consequence, more positive rating changes are anticipated to occur in the future. This line of reasoning in the opposite direction applies to negative credit events affecting the inferior ratings. Rating divergence as a result of such events implies an increased ambiguity about credit risk. In this context, the evidence on the stronger spread reactions occurring in the particular case of negative events by S&P on the inferior ratings (which has the effect of increasing split ratings) lends empirical support to the principle of trading behaviour under ambiguity aversion proposed by Epstein and Schneider (2008). S&P negative events and Moody's positive events bring greater information content to the sovereign debt markets. In this respect, the results are in line with the lead-lag relations between global CRAs in the sovereign sector, whereby S&P tends to lead in downgrade trends and Moody's tends to lead in upgrade trends (Alsakka and ap Gwilym, 2010).

The findings suggest that market participants only take into consideration the rating differentials between S&P and Moody's and not those with Fitch. Table 5 shows that, in most specifications of Eq. (2), the influence of Fitch credit events (affecting both superior and inferior Fitch-rated sovereigns) on the market perception of sovereign risk is very minimal. Furthermore, Tables 3 and 4 show that the rating differentials which involve Fitch ratings do not make a distinct difference to the market responses to credit events by Moody's and S&P.

It is evident from most of the specifications that adding common global risk factors substantially improves the explanatory power of Eq. (2), especially that the VIX index and the US Treasury interest rates impose significant contemporary impacts on spreads in most specifications. Prior research highlights the importance of international common risk factors in determining the credit spreads apart from market liquidity risk and sovereign specific fundamentals (e.g. Longstaff and Schwartz, 1995; Favero et al., 2010; Oliveira et al., 2012). We find that spreads are positively related to market implied volatilities and swap spreads, and inversely related to the US Treasury rates.

5.3. Robustness checks

5.3.1. Using ΔLCCR instead of ΔCCR

As a first robustness check, we account for possible non-linearity in the rating scale and apply a logit type transformation to the 58-unit linear rating scale (Sy, 2004):

$$LCCR_{it} = \ln\left[\frac{CCR_{it}}{(59 - CCR_{it})}\right]$$

This conversion method allows wider gaps in default probabilities between two adjacent CCR points at the top and bottom ends of the rating scales than between two adjacent CCR points in the middle of the scale. Thus, it also allows the spreads' sensitivity to credit rating events to vary according to the sovereigns' rating levels. The credit event variable in Eq. (2) is re-defined as $\Delta LCCR_{it}$, i.e. the change in $LCCR_{it}$. We also re-define the control variable for event clustering $PRIOREVENTS_{it}$ as the net cumulative LCCR changes of sovereign *i* during 14 days prior to the event date *t*.[8]

The conclusions regarding spreads' reactions to credit events are confirmed. Negative events have a significant impact on the bond market, whereas positive events have a more muted effect. Consistent with the results in Tables 3-5, the most significant spread movements are observed following negative events by the more conservative CRA, which is S&P. The coefficient estimates on $\Delta LCCR_{it} \times INF_{it}$ and $\Delta LCCR_{it} \times SUP_{it}$ in the S&P negative events model (S&P vs. Moody's) are 172.56 and 73.22 basis points respectively. The

[8] The tabulated results are available from the authors on request.

first coefficient implies a highly significant increase of sovereign spreads by 34.51 (172.56*0.2) basis points in response to a downgrade by one notch on S&P's inferior rating (versus Moody's) from the 'BBB-' category. The latter coefficient implies a weaker increase in spreads by 14.64 (73.22*0.2) basis points for a downgrade by one notch on S&P's superior rating (versus Moody's) from the same rating category.[9] The earlier results concerning the sensitivity of sovereign spreads to Moody's positive events remain valid when using $\Delta LCCR$ and this robustness check yields little evidence for the information content of Fitch's events in the context of split sovereign ratings.

5.3.2. The 'triple-rating' case

In the previous sections, the rating differences consider each pair of CRAs. As a robustness test, we consider rating differences where sovereigns are rated by all three CRAs. In our sample, 92% (736/800) of sovereign credit events are for 56 sovereigns that are rated by all three CRAs (261 are announced by S&P, 237 by Moody's and 238 by Fitch). For an event announced by CRA *j* for sovereign *i* on day *t*, we now define three scenarios:

(i) CRA *j* assigns the 'superior rating' when the pre-event rating by CRA *j* is superior to both of the remaining CRAs or superior to one of them and equal to the other.

(ii) CRA *j* assigns the 'inferior rating' when the pre-event rating by CRA *j* is inferior to both of the remaining CRAs or inferior to one of them and equal to the other.

(iii) CRA *j* assigns the 'between rating' when the pre-event rating by CRA *j is* superior to one CRA and inferior to the other.

To examine the market reactions in the "triple-rating" case, we estimate the following model:

[9] The LCCR equivalents of one-CCR unit downgrade and one-notch downgrade from the rating category 'BBB-/Baa3' are 0.07 and 0.2 respectively, using the CCR transformation formula.

$$\Delta SPREAD_{it} = \alpha + \beta_1 \Delta CCR_{it} \times SUP_{it} + \beta_2 \Delta CCR_{it} \times INF_{it} + \beta_3 \Delta CCR_{it} \times BET_{it} + \gamma_1 MATURITY_{it} + \gamma_2 CCR_{it} + \gamma_3 PRIOREVENTS_{it} + \gamma_4 GRISK_t + \delta reg_i + \varphi y_t + \varepsilon_{it} \quad (3)$$

The credit event ΔCCR_{it} is interacted with three dummies: SUP_{it} equals one if CRA *j* assigns the 'superior rating' (scenario (i)), INF_{it} equals one if CRA *j* assigns the 'inferior rating' (scenario (ii)), and BET_{it} equals one if CRA *j* assigns the 'between rating' (scenario (iii)) and zero otherwise. CCR_{it} is the average of three pre-event credit ratings assigned by the three CRAs to sovereign *i* on day -1.

In general, the results of Eq. (3) are consistent with our evidence from Eq. (2) for the 'dual-rating' case.[10] There is an asymmetric effect of positive and negative credit signals whereby spreads are more responsive to negative ones. Credit spreads increase by 10.37 basis points in reaction to a negative outlook event on the inferior ratings by S&P (versus Moody's and Fitch), while spreads increase by 6.15 (7.12) basis points in reaction to a negative outlook event on the superior ratings (between ratings) by S&P. We only obtain significant spread reactions to Moody's positive events in cases of superior ratings versus S&P and Fitch, while we find no significant coefficients for Fitch's positive events.

[10] The tabulated results are available from the authors on request.

6. Conclusions

Using a rich dataset of credit events by Moody's, S&P and Fitch for 68 split-rated sovereigns from September 2000 to December 2012, we analyse the role of split ratings in determining the information content of credit events in the sovereign bond markets. Ratings, outlook and watch status for each day are converted into a 58-unit comprehensive credit rating (CCR) numerical score (Sy, 2004).

In contrast with Livingston et al.'s (2010) evidence that Moody's is more conservative than S&P in corporate ratings, we show that S&P is the most conservative CRA for sovereign issuers during this sample period. The differences between the three largest CRAs are often within 1 - 3 CCR units (i.e. outlook, watch or one rating notch), though the splits do reach 18 CCR units (6 rating notches). We find that CRAs increasingly employ outlook and watch signals to indicate potential downgrades and upgrades, and Moody's is the most active CRA in releasing outlook and watch signals before sovereign rating changes.

The originality of this study arises from analysing the bond market impact of sovereign credit events from the perspective of split ratings. Specifically, we investigate whether bond market reactions to credit events from a particular CRA differ depending on whether the affected ratings by the respective CRA are pre-event superior or inferior to those assigned by other CRAs. We anticipate that positive events on the superior ratings (negative events on the inferior ratings) convey stronger information value to the bond markets than positive events on inferior ratings (negative events on superior ratings). The former types of events set a new rating ceiling (floor), hence affect the market more strongly than the latter types of events. Our prediction of the differential effects of negative events on spreads is also in line with a viewpoint of trading behaviour under ambiguity aversion in Epstein and Schneider (2008). Specifically, split ratings reflect inconsistent information, hence giving rise to ambiguity about sovereign default risk. Ambiguity increases when split ratings widen, and split ratings widen when inferior ratings are downgraded. Market participants exhibit aversion to ambiguity, so there is a stronger reaction in spreads to negative rating changes on the pre-event inferior ratings. Our empirical results support this argument and are consistent with the prior empirical evidence from stock prices of small (ambiguous) firms reported in Antoniou et al. (2014).

Although split ratings involving three pairs of CRAs are tested, we find that only the splits between S&P and Moody's impose a clear impact on sovereign credit spreads' sensitivity to credit events. Spread adjustments to S&P negative events are more pronounced when S&P assigns the inferior pre-event ratings (compared with Moody's). Moody's positive events have a significant impact when Moody's assigns superior pre-event ratings than S&P. There is little evidence that Fitch credit events have a significant market implication nor is there evidence that rating differences involving Fitch affect the market reactions to credit events by Moody's and S&P. The results are robust to the definition of rating scales (the 58-unit linear comprehensive credit rating scale and its logit transformation which accounts for non-linearity in the rating scale). We further contribute to the literature by considering the case of split ratings among the three CRAs simultaneously, for those sovereigns which are assigned three ratings. These results are broadly consistent with those for CRA pairs.

These findings will be of interest to various parties. First, split ratings are too important to be ignored by sovereign issuers because borrowing costs suffer more when the inferior ratings are lowered than when the superior ratings are lowered. Second, the findings are useful for policy makers with respect to monitoring and regulating CRAs. Third, market participants' perspectives of sovereign risk are still heavily driven by the credit opinions and divergence in credit opinions between S&P and Moody's, despite gains in market share by Fitch. This final point has relevance for the current debates on CRA competition and business models.

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Table 1

Data summary of credit events for split rated sovereigns - CRA pairs

(1)	**(2)**	**Group 1**		**Group 2**		**Group 3**	
		S&P (3)	**Moody's (4)**	**S&P (5)**	**Fitch (6)**	**Moody's (7)**	**Fitch (8)**
1	No of sovereign bonds	113		107		94	
2	No of countries	61		57		47	
3	Average term to maturity (years)	7.5		6.8		7.0	
4	Average coupon rate (%)	7.5		7.5		7.6	
5	Average amount issued (billion USD)	1.5		1.6		1.6	
6	Average number of events per bond	4.3		3.7		4.4	
7	Average number of events per country	7.9		7.0		8.9	
8	**Absolute mean rating differentials (CCR units)**	**3.1**		**2.9**		**2.9**	
9	Standard deviation of absolute rating differentials (CCR units)	2.2		2.7		2.1	
10	Minimum of absolute rating differentials (CCR units)	1		1		1	
11	Maximum of absolute rating differentials (CCR units)	15		18		13	
12	The first CRA assigns inferior ratings (%)	56.7		64.4		52.2	
13	**Number of negative events**	**104**	**84**	**86**	**87**	**73**	**85**
14	*The respective CRA assigns inferior ratings (% of row 13)*	*59.6*	*14.3*	*54.7*	*9.2*	*31.5*	*30.6*
15	*The respective CRA assigns superior ratings (% of row 13)*	*40.4*	*85.7*	*45.3*	*90.8*	*68.5*	*69.4*
16	**Number of positive events**	**146**	**149**	**122**	**104**	**136**	**122**
17	*The respective CRA assigns inferior ratings (% of row 16)*	*66.4*	*71.1*	*82.8*	*71.2*	*72.8*	*70.5*
18	*The respective CRA assigns superior ratings (% of row 16)*	*33.6*	*28.9*	*17.2*	*28.8*	*27.2*	*29.5*
19	**Number of credit events**	**250**	**233**	**208**	**191**	**209**	**207**

Table 1 reports the summary statistics of credit events by each pair of CRAs for 68 split rated sovereigns from September 2000 to December 2012. Group 1 (2) refers to all events announced by S&P and Moody's (Fitch) on sovereigns rated unequally by S&P and Moody's (Fitch) before the events occur, and Group 3 refers to all events announced by Moody's and Fitch on sovereigns rated unequally by Moody’s and Fitch before the events occur.

Table 2

Sovereign yield spreads' reactions to credit events by global CRAs on split rated sovereigns (Eq. (1))

Panel A. Negative events

Explanatory Variables	S&P				Moody's				Fitch			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Constant	0.61	-0.07	1.41	0.72	17.15	15.77	15.11	18.22	0.34	1.42	2.96	1.52
	(0.07)	(-0.00)	(0.09)	(0.04)	(1.47)	(1.06)	(1.02)	(1.25)	(0.08)	(0.13)	(0.28)	(0.14)
ΔCCR	**7.57****	**8.40*****	**8.51*****	**8.59*****	4.12	3.54	3.80	3.69	1.95	1.73	1.73	2.10
	(2.46)	**(2.71)**	**(2.71)**	**(2.72)**	(1.62)	(1.25)	(1.34)	(1.33)	(1.21)	(1.22)	(1.18)	(1.47)
MATURITY		1.55	0.86	1.44		-2.04	-1.60	-1.50		1.18	1.08	1.18
		(0.49)	(0.27)	(0.47)		(-0.67)	(-0.55)	(-0.50)		(0.51)	(0.47)	(0.52)
CCR		-0.06	-0.06	-0.06		-0.00	-0.00	-0.06		-0.08	-0.11	-0.09
		(-0.16)	(-0.17)	(-0.18)		(-0.00)	(-0.01)	(-0.33)		(-0.54)	(-0.72)	(-0.57)
PRIOREVENTS		2.07	2.01	1.99		**-4.062***	**-3.844***	**-4.76****		-0.47	-0.29	-0.30
		(1.25)	(1.26)	(1.15)		**(-1.85)**	**(-1.70)**	**(-2.24)**		(-0.40)	(-0.25)	(-0.26)
GRISK (VIX Index)		-29.03				24.51				**52.35*****		
		(-0.62)				(0.70)				**(3.43)**		
GRISK (US Treasury Rate)			-131.90				**-186.20***				**-150.40*****	
			(-0.68)				**(-1.85)**				**(-3.04)**	
GRISK (US Swap Spreads)				37.29				**120.90***				**50.13***
				(0.64)				**(1.81)**				**(1.82)**
Time dummies (*y*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies (*reg*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	238	238	238	238	172	172	172	172	172	172	172	172
Adj. R-squared (%)	6.2	5.3	5.7	5.3	4.9	5.8	7.0	8.1	1.6	4.5	5.1	2.8

Table 2 – Continued

Panel B. Positive events

Explanatory Variables	S&P				Moody's				Fitch			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Constant	0.75	-3.65	-3.39	-3.72	-2.74	-1.20	-2.68	-2.24	-0.47	-2.65	-4.11	-2.88
	(0.31)	(-0.48)	(-0.45)	(-0.48)	(-1.31)	(-0.29)	(-0.67)	(-0.54)	(-0.29)	(-0.83)	(-1.42)	(-0.89)
ΔCCR	0.52	0.63	0.39	0.62	0.18	-0.11	0.07	-0.05	0.38	0.47	**0.58****	0.43
	(1.06)	(1.44)	(0.96)	(1.42)	(0.45)	(-0.25)	(0.16)	(-0.10)	(1.34)	(1.56)	(2.56)	(1.37)
MATURITY		2.22	2.36	2.18		-0.50	-0.35	-0.30		0.63	0.96	0.52
		(0.89)	(0.97)	(0.88)		(-0.55)	(-0.39)	(-0.33)		(0.95)	(1.64)	(0.75)
CCR		0.01	-0.00	0.01		0.01	0.02	-0.00		0.05	0.04	0.05
		(0.05)	(-0.00)	(0.07)		(0.22)	(0.50)	(-0.05)		(1.11)	(0.96)	(0.96)
PRIOREVENTS		**-2.57****	**-2.02***	**-2.19***		3.71	3.93	4.19		0.03	-0.13	0.05
		(-2.00)	**(-1.72)**	**(-1.72)**		(1.42)	(1.47)	(1.64)		(0.05)	(-0.36)	(0.09)
GRISK (VIX Index)		18.37				**48.22*****				**34.26*****		
		(1.04)				**(4.20)**				**(3.99)**		
			-288.40***				**-201.30*****				**-244.20*****	
GRISK (US Treasury Rate)			**(-5.38)**				**(-5.74)**				**(-7.62)**	
				15.47				9.10				**21.97****
GRISK (US Swap Spreads)				(0.72)				(0.49)				**(2.29)**
Time dummies (*y*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies (*reg*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	346	346	346	346	326	326	326	326	292	292	292	292
Adj. R-squared (%)	0.3	0.2	6.0	0.0	0.1	8.8	12.9	2.0	0.4	6.5	25.6	1.0

The table reports the results of Eq. (1), using credit events by Moody’s, S&P and Fitch for 68 split rated sovereigns from September 2000 to December 2012 (see Table 1). The dependent variable is Δ*SPREAD* which measures, in basis points, the changes in the [0, +1] window of sovereign yield spreads, against US benchmark bonds, on the outstanding bond issued by the sovereign *i* subject to the credit event on day t. The independent variables are defined as follows. *ΔCCR* is the credit event variable, measuring the change in the 58-unit CCR for sovereign *i* on event date *t*. *MATURITY* is the natural logarithm of the remaining years to maturity for the bond issued by sovereign *i* on the event date *t*. *CCR* is the comprehensive credit rating assigned to sovereign *i* before the credit event on date *t*. *PRIOREVENTS* is the cumulative CCR changes of the sovereign *i* in 14 days prior to day *t*. *GRISK* is a proxy of a global risk factor; we estimate Eq. (1) with one of the three proxies of global risk including: CBOE VIX index, the 5 year interest rate swap spreads over US Treasury curve and the 10 year US Treasury interest rate. Since spreads are benchmarked against the US sovereign interest rates, we opt for US based measures of international risk due to their exogenous property. We control for the fixed-effects of geographic regions and time trends by adding a full set of region dummy variables *reg* and time dummy variables *y*. We estimate Eq. (1) separately for positive events and negative events, and for ease of interpretation, we take the absolute values of ΔCCR. We apply Huber–White robust standard errors. Outliers are excluded. T-values are in parenthesis. ***, **, and * refer to significant coefficients at 1%, 5% and 10% levels.

Table 3

Sovereign yield spreads' reactions to credit events by S&P on split rated sovereigns (Eq. (2))

Explanatory Variables	S&P's negative events								S&P's positive events							
	S&P vs. Moody's				S&P vs. Fitch				S&P vs. Moody's				S&P vs. Fitch			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Constant	-0.07	-5.22	-2.60	-3.60	-12.02	-46.82	-37.63	-45.54	1.83	-5.49	-4.71	-4.94	-0.20	**-11.01***	-8.77	-10.61
	(-0.01)	(-0.31)	(-0.15)	(-0.21)	(-1.06)	(-0.91)	(-0.83)	(-0.88)	(1.10)	(-1.32)	(-1.26)	(-1.18)	(-0.14)	**(-1.69)**	(-1.44)	(-1.62)
ΔCCR×SUP (1)	2.82	3.34	**3.51***	3.40	**11.68***	11.64	12.12	11.36	**-1.58***	-0.87	-0.82	-1.20	-3.15	-2.41	-3.50	-2.63
	(1.38)	(1.57)	**(1.68)**	(1.60)	**(1.77)**	(1.63)	(1.62)	(1.52)	(-1.78)	(-0.99)	(-1.12)	(-1.34)	(-1.23)	(-0.94)	(-1.40)	(-1.02)
ΔCCR × INF (2)	**12.68****	**13.14*****	**13.12****	**13.40*****	**3.52***	**4.19***	**4.99***	**4.63***	0.02	0.28	0.11	0.26	0.14	0.35	0.12	0.43
	(2.57)	**(2.70)**	**(2.60)**	**(2.64)**	**(1.74)**	**(1.70)**	**(1.66)**	**(1.69)**	(0.04)	(0.67)	(0.35)	(0.66)	(0.36)	(0.94)	(0.34)	(1.13)
MATURITY		4.24	3.26	3.56		10.75	6.36	10.93		**2.66*****	**2.83*****	**2.29****		2.86*	2.50	2.58
		(1.19)	(0.94)	(1.04)		(1.02)	(0.79)	(1.04)		**(2.77)**	**(3.27)**	**(2.34)**		(1.72)	(1.61)	(1.60)
CCR		-0.05	-0.05	-0.04		0.47	0.44	0.46		0.05	0.03	0.06		0.17	0.15	0.17
		(-0.12)	(-0.13)	(-0.10)		(0.59)	(0.58)	(0.57)		(0.86)	(0.52)	(0.95)		(1.51)	(1.45)	(1.55)
PRIOREVENTS		1.17	1.27	1.18		0.76	0.44	0.41		**-3.69*****	**-2.79*****	**-2.68****		**-2.78*****	**-2.09****	**-2.07****
		(0.81)	(0.86)	(0.78)		(0.41)	(0.25)	(0.20)		**(-3.43)**	**(-2.88)**	**(-2.51)**		**(-3.11)**	**(-2.45)**	**(-2.45)**
GRISK		-60.06				-29.99				**42.72*****				**31.68****		
(VIX Index)		(-1.09)				(-0.43)				**(3.38)**				**(2.14)**		
GRISK			-124.40				-572.6				**-281.2*****					
(US Treasury Rate)			(-0.57)				(-1.19)				**(-6.56)**				(-5.48)	
GRISK				32.71				95.09				**45.62****				30.19
(US Swap Spreads)				(0.50)				(0.97)				**(2.52)**				(1.28)
Time & region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	200	200	200	200	168	168	168	168	286	286	286	286	238	238	238	238
Adj. R-squared %	9.2	8.6	8.1	7.8	3.0	2.6	6.6	3.1	0.7	8.2	23.3	6.7	0.4	2.8	13.1	2.4
F-statistics (1) = (2)	**3.93****	**3.87***	**3.53***	**3.75***	1.68	1.16	0.93	0.81	**2.95***	1.68	1.58	2.60	1.68	1.19	2.16	1.46

The table reports the results of Eq. (2), using events by S&P from September 2000 to December 2012 on sovereigns jointly and unequally rated by S&P and either Moody's or Fitch (See Table 1). "S&P vs. Moody's" and "S&P vs. Fitch" indicate that the samples of interest contain events on sovereigns also rated respectively by Moody's and Fitch. The dependent variable is Δ*SPREAD* which measures, in basis points, the changes in the [0, +1] window of sovereign yield spreads, against US benchmark bonds, on the outstanding bond issued by the sovereign *i* on day *t*. See Table 2 for the definition of *ΔCCR*, *MATURITY*, *CCR*, *PRIOREVENTS* and *GRISK*. "*SUP*" and "*INF*" are the dummies of superior and inferior ratings assigned by S&P compared with either Moody's or Fitch on day -1. F-statistic indicates the test of equality of coefficients on two rating change variables. Outliers are excluded from every model specification. We apply Huber–White robust standard errors. T-values are in parenthesis. ***, **, and * refer to significant coefficients at 1%, 5% and 10% levels.

Table 4
Sovereign yield spreads' reactions to credit events by Moody's on split rated sovereigns (Eq. (2))

Explanatory Variables	**Moody's negative events**								**Moody's positive events**							
	Moody's vs. Fitch				**Moody's vs. S&P**				**Moody's vs. Fitch**				**Moody's vs. S&P**			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Constant	**34.38***	**44.46***	**41.88***	**47.68***	16.84	11.81	11.48	13.18	-0.71	-4.42	-4.78	-5.74	-0.28	0.43	-0.06	1.15
	(1.72)	**(1.78)**	**(1.73)**	**(1.91)**	(1.40)	(0.70)	(0.68)	(0.80)	(-0.26)	(-0.79)	(-0.84)	(-1.03)	(-0.16)	(0.13)	(-0.02)	(0.35)
ΔCCR×SUP (1)	**5.34***	5.30	5.54	5.22	**4.97***	4.30	4.61	4.47	-2.66	-3.04	-2.56	-3.37	**-2.92****	**-2.90****	**-2.50****	**-2.81****
	(1.66)	(1.53)	(1.63)	(1.51)	(1.76)	(1.37)	(1.46)	(1.46)	(-1.06)	(-1.19)	(-0.98)	(-1.28)	**(-2.30)**	**(-2.33)**	**(-2.11)**	**(-2.16)**
ΔCCR × INF (2)	**2.74****	**2.56***	2.19	**3.47****	-0.99	-0.81	-0.98	-1.87	-0.46	-0.51	-0.49	-0.57	0.11	-0.07	0.10	0.06
	(2.12)	(1.82)	(1.41)	(2.17)	(-0.17)	(-0.13)	(-0.16)	(-0.29)	(-0.89)	(-0.92)	(-0.88)	(-0.97)	(0.30)	(-0.19)	(0.25)	(0.16)
MATURITY		0.22	1.39	0.65		-0.74	-1.02	-0.61		1.01	0.81	1.23		0.01	-0.15	-0.16
		(0.05)	(0.33)	(0.17)		(-0.22)	(-0.30)	(-0.18)		(0.80)	(0.61)	(0.98)		(0.02)	(-0.21)	(-0.20)
CCR		-0.36	-0.37	-0.42		0.07	0.06	0.03		0.06	0.07	0.08		-0.01	0.00	-0.04
		(-1.41)	(-1.41)	(-1.57)		(0.35)	(0.30)	(0.17)		(0.80)	(0.83)	(0.96)		(-0.26)	(0.08)	(-0.92)
PRIOREVENTS		-0.56	-0.58	-1.02		**-4.22***	-3.89	**-4.71****		**1.97***	**2.19****	**2.58****		1.16	1.20	1.86
		(-0.48)	(-0.51)	(-0.79)		**(-1.76)**	(-1.61)	**(-2.05)**		**(1.82)**	**(2.16)**	**(2.14)**		(0.92)	(1.00)	(1.36)
GRISK		**94.73****				-4.00				**53.58*****				**40.72*****		
(VIX Index)		**(2.55)**				(-0.11)				**(3.76)**				**(4.12)**		
GRISK			**-327.1****				-178.0				**-202.0*****				**-229.5*****	
(US Treasury Rate)			**(-2.43)**				(-1.55)				**(-3.75)**				**(-7.74)**	
GRISK				106.5				**127.1***				14.36				**32.71***
(US Swap Spreads)				(1.18)				**(1.94)**				(0.63)				**(1.91)**
Time & Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	144	144	144	144	156	156	156	156	260	260	260	260	292	292	292	292
Adj. R-squared (%)	11.7	13.3	14.1	11.8	5.6	6.0	7.1	8.9	0.2	7.3	10.1	0.5	4.5	11.0	24.4	6.0
F-statistics (1) = (2)	0.79	0.77	1.07	0.31	1.00	0.68	0.78	0.93	0.76	1.02	0.65	1.14	**5.44****	**4.89****	**4.40****	**4.64****

The table reports the results of Eq. (2), using events by Moody's from September 2000 to December 2012 on sovereigns jointly and unequally rated by Moody's and either S&P or Fitch (See Table 1). "Moody's vs. S&P" and "Moody's vs. Fitch" indicate that the samples of interest contain events on sovereigns also rated respectively by S&P and Fitch. The dependent variable is Δ*SPREAD* which measures, in basis points, the changes in the [0, +1] window of sovereign yield spreads, against US benchmark bonds, on the outstanding bond issued by the sovereign *i* on day *t*. See Table 2 for the definitions of *ΔCCR*, *MATURITY*, *CCR*, *PRIOREVENTS* and *GRISK*. "*SUP*" and "*INF*" are the dummies of superior and inferior ratings assigned by Moody's compared with either S&P or Fitch on day -1. F-statistics indicate the test of equality of coefficients on the two rating change variables. Outliers are excluded from every model specification. We apply Huber–White robust standard errors. T-values are in parenthesis. ***, **, and * refer to significant coefficients at 1%, 5% and 10% levels.

Table 5

Sovereign yield spreads' reactions to credit events by Fitch on split rated sovereigns (Eq. (2))

Explanatory Variables	Fitch's negative events								Fitch's positive events							
	Fitch vs. S&P				Fitch vs. Moody's				Fitch vs. S&P				Fitch vs. Moody's			
	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)	(I)	(II)	(III)	(IV)
Constant	1.80	10.99	8.13	9.80	-11.04	-2.96	-3.71	-5.26	-1.29	-7.18**	-7.12**	-4.11	-1.52	0.69	-0.87	-0.59
	(0.51)	(0.97)	(0.70)	(0.87)	(-1.20)	(-0.16)	(-0.19)	(-0.27)	(-0.72)	(-1.99)	(-2.23)	(-1.13)	(-0.77)	(0.15)	(-0.21)	(-0.13)
ΔCCR×SUP (1)	2.58	2.26	2.29	2.42*	-2.07	-3.42	-3.42	-3.36	0.68	1.38*	1.17**	0.80	-0.38	-0.24	0.27	-0.53
	(1.58)	(1.65)	(1.58)	(1.71)	(-0.90)	(-1.39)	(-1.38)	(-1.35)	(0.86)	(1.80)	(1.98)	(0.92)	(-0.44)	(-0.25)	(0.40)	(-0.56)
ΔCCR × INF (2)	3.10	2.71	4.02	2.99	2.09	-0.48	-0.22	-0.46	0.14	0.28	0.17	0.12	0.37	0.34	0.53**	0.38
	(1.01)	(0.79)	(1.29)	(0.93)	(0.89)	(-0.18)	(-0.08)	(-0.17)	(0.27)	(0.49)	(0.42)	(0.19)	(1.28)	(1.12)	(2.27)	(1.23)
MATURITY		0.28	0.66	0.22		1.71	2.23	2.51		0.78	0.54	-0.03		-0.56	-0.30	-0.47
		(0.10)	(0.25)	(0.08)		(0.33)	(0.45)	(0.50)		(0.96)	(0.74)	(-0.03)		(-0.55)	(-0.32)	(-0.44)
CCR		-0.23	-0.20	-0.23		-0.22	-0.20	-0.19		0.15**	0.13**	0.09		0.00	-0.01	0.00
		(-1.44)	(-1.21)	(-1.39)		(-1.03)	(-0.85)	(-0.81)		(2.33)	(2.42)	(1.48)		(0.07)	(-0.10)	(0.02)
PRIOREVENTS		-0.69	-0.48	-0.49		-2.83	-2.44	-2.71		-0.20	-0.39	-0.20		0.07	-0.33	0.11
		(-0.59)	(-0.42)	(-0.41)		(-1.05)	(-0.95)	(-1.00)		(-0.28)	(-0.69)	(-0.26)		(0.13)	(-0.87)	(0.20)
GRISK		52.36**				64.10				43.20***				33.30***		
(VIX Index)		(2.52)				(1.19)				(4.57)				(3.31)		
GRISK			-151.0***				-193.5*				-228.1***				-282.0***	
(US Treasury Rate)			(-3.47)				(-1.83)				(-6.03)				(-8.17)	
GRISK				24.64				27.86				20.36				23.84**
(US Swap Spreads)				(0.97)				(0.55)				(1.32)				(2.06)
Time & region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	148	148	148	148	162	162	162	162	192	192	192	192	242	242	242	242
Adj. R-squared (%)	4.7	8.8	10.2	5.3	0.1	3.8	3.2	1.8	0.2	11.0	23.3	0.7	0.2	5.2	28.7	0.2
F-statistics (1) = (2)	0.03	0.02	0.29	0.03	1.74	0.81	0.94	0.78	0.37	1.62	2.37	0.50	0.83	0.41	0.18	1.03

The table reports the results of Eq. (2), using events by Fitch from September 2000 to December 2012 on sovereigns jointly and unequally rated by Fitch and either S&P or Moody's (See Table 1). "Fitch vs. S&P" and "Fitch vs. Moody's" indicate that the samples of interest contain events on sovereigns also rated respectively by S&P and Moody's. The dependent variable is ΔSPREAD which measures, in basis points, the changes in the [0, +1] window of sovereign yield spreads, against US benchmark bonds, on the outstanding bond issued by the sovereign *i* on day *t*. See Table 2 for the definition of *ΔCCR*, *MATURITY*, *CCR*, *PRIOREVENTS* and *GRISK*. "*SUP*" and "*INF*" are the dummies of superior and inferior ratings assigned by Fitch compared with either S&P or Moody's on day -1. Outliers are excluded from model specification. F-statistic indicates the test of equality of coefficients on two rating change variables. F-statistic indicates the test of equality of coefficients on two rating change variables. We apply Huber–White robust standard errors. T-values are in parenthesis. ***, **, and * refer to significant coefficients at 1%, 5% and 10% levels.